

⑫

EUROPEAN PATENT SPECIFICATION

⑬ Date of publication of patent specification: 03.10.90

⑭ Int. Cl.⁵: A 61 B 3/02, A 61 H 5/00

⑮ Application number: 85303889.1

⑯ Date of filing: 03.06.85

⑰ **Perimetric method and apparatus.**

⑱ Priority: 16.04.85 GB 8509741
05.06.84 GB 8414358

⑲ Date of publication of application:
18.12.85 Bulletin 85/51

⑳ Publication of the grant of the patent:
03.10.90 Bulletin 90/40

㉑ Designated Contracting States:
BE DE FR GB IT

㉒ References cited:
FR-A-2 301 215
US-A-1 959 217
US-A-2 442 255
US-A-3 025 755
US-A-3 328 113

㉓ Proprietor: The University Court of the
University of Glasgow
The University
Glasgow G12 8QQ Scotland (GB)

㉔ Inventor: Damato, Bertil Eric
35 Falkland Street
Glasgow, G12 9QZ Scotland (GB)

㉕ Representative: Szczuka, Jan Tymoteusz et al
Cruikshank & Fairweather 19 Royal Exchange
Square
Glasgow G1 3AE Scotland (GB)

EP 0 164 981 B1

Note: Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European patent convention).

D scripti n

The present invention relates to ocular perimetry and in particular to a device for use in ocular perimetry.

Conventionally ocular perimetric methods for use in the diagnosis and management of diseases of the eyes and brain (e.g. glaucoma, retinitis pigmentosa, tumours etc.) are based on the use of a mobile optical target element around a central reference target element. The subject's eye is fixed on the reference target while the mobile target element is moved around it and any points at which the subject is unable to see the mobile target while still fixing his eye on the reference target, are recorded. These methods however suffer from a number of serious disadvantages. In the first place it is very difficult for the subject to maintain his eye in fixed alignment on the target and any deviation results in inaccuracies of measurement. Accordingly it is necessary for an operator to monitor the subject to identify any deviations of the eye as well as recording the results of the subjects response at different positions of the mobile target. Furthermore the conventional apparatus with the mobile target element, generally in the form of flashing lights, is very expensive.

U.S. Patent 3025755 describes a device having a central reference target which flashes on and off in order to attempt to keep the subject's eye focussed thereon, and an array of test lights around it.

French Patent 2301215 proposes the use of light emitting diodes as the test lights. However, the problem of maintaining the subject's eye fixed on the central reference target remains.

It is an object of the present invention to avoid or minimize one or more of the above disadvantages.

The present invention provides an oculo-perimetric device for use in measuring the field of vision of a subject which device comprises an extended area visual target having a large plurality of generally regularly, angularly and/or radially, spaced apart individual target elements disposed around a central reference target element across substantially the whole of the area within a predetermined radial separation from said reference target, said individual target elements being provided with sequence indicating means formed and arranged so as to define a visually discernible predetermined sequence for fixing of an eye of the subject, in use of the device, on successive adjacent individual target elements, said central reference target element being formed and arranged so as to be visually more prominent than said individual target elements.

Measuring the field of vision of a subject usually comprises the steps of providing an oculo-perimetric device of the invention, supporting said device at a predetermined distance from an eye of said subject of not more than 3 times said predetermined radial separation, facing an

eye of the subject to be tested, shading any other eye of the subject, and recording any of said individual target elements within said predetermined sequence of observation thereof at which individual target element said subject is unable to see said reference target when said eye is fixed on said individual target element.

Thus with the device of the present invention it is possible to obtain a good measurement of the central part of the field of vision of a subject i.e. that part subtending an angle of the order of 20 to 25° either side of the central axis in the field of view of the eye along which the eye is directed, in a simple and quick manner which at the same time is very much more economical than previously known systems for ocular perimetry.

Further preferred features and advantages of the invention will appear from the following detailed description given by way of example of a preferred embodiment illustrated with reference to the accompanying drawings in which:

Fig. 1 shows a device of the invention;

Fig. 2 is a schematic perspective view of the device of Fig. 1 in use in a method of the invention; and

Fig. 3 shows part of a completed record sheet obtained in the method of Fig. 2.

Fig. 1 shows an oculo-perimetric device of the invention comprising a visual target in the form of a card 1 having printed thereon against a pale unsaturated colour background, in a pale unsaturated colour such as light blue, light green or pink, a plurality of individual target elements 2 around a central reference target 3 which is a dark saturated colour, usually black, so as to be substantially more visually prominent than the reduced visibility individual target elements 2. This helps to reduce confusion between the individual target elements 2 and the central reference target 3. As may be seen in the drawing the individual target elements 2 are more or less regularly spaced angularly around the reference target 3 and radially therefrom so as to substantially occupy the whole of the area within a predetermined radial separation R from the central reference target 3.

Conveniently the central test target is in the form of a series of faint concentric circles which may be filled in with black ink prior to the commencement of the test as required depending upon the size of central test target required by the subjects visual ability.

The individual target elements 2 are in the form of a sequence of numbers running from 1 to 100 with lines 4 interconnecting successive numbers which are disposed adjacently. In this way there is defined a predetermined sequence of the individual target elements 2 which can be followed by the subject's eye 5 (see Fig. 2). The interconnecting lines assist the subject, especially an illiterate one, in following a predetermined sequence through the individual target elements. The use of target elements in the form of numbers, or alternatively alphabetical characters, aids in rapid and certain identification of the individual por-

tions of the subject's field of view being tested at any given moment. On the one hand this facilitates recording of the results of the measurement and on the other hand also facilitates transmission and further processing of the data obtained through telephone and/or computer apparatus.

As shown in Fig. 2 the target card 1 is supported at a distance L from the subject's eye 5 such that the radius R of the area filled by the target elements 2 subtends an angle α of about 20 to 25° at the eye. Thus for example a card having a radius R of 45 cm would conveniently be supported at a distance L of 100 cm from the subject's eye. Conveniently the card includes at its base 6 distance setting means in the form of an eye fixing spot 7 and right and left eye targets 8 and 9 respectively, separated therefrom at a distance L such that when the card is held at the distance L from the left eye which is fixed on the eye fixing spot 7 the left eye target 9 coincides with that eye's blind spot and thus cannot be seen. For the purposes of reproducibility and comparison it is clearly desirable that the card should be supported at the same relative distance for every test so that any given individual target element always corresponds to the same part of the eye's field of vision.

The test is carried out in a well lit environment and repeated under the same conditions. One eye is tested at a time while the other is occluded. As the subject reads these numbers in numerical order the movement of the eye induces a relative centripetal displacement of the central target in the visual field. Defects in the visual field are plotted by noting the numbers which are associated with disappearance of the central target. Conveniently these are plotted on a record sheet bearing a reduced size representation of the target.

The results are interpreted by a trained individual. To compare the result with one obtained by conventional techniques the completed record sheet is inverted (Fig. 3). The presence and position of the normal blind spot on the record sheet provides a guide to the reliability of the patient's responses. The position of the blind spot (distance from the central reference target) will also indicate whether the test was carried out at the correct working distance or not.

For the purposes of self assessment, to which the present invention is particularly and uniquely well suited, a smaller size of target card with a radius R of 15 cm and a viewing distance L of 33 cm which can be used without glasses is generally more convenient.

It will of course be appreciated that the above device can be modified in various ways without departing from the scope of the claims. In particular various other sequences of individual targets could be used including for example spiral arrangements. In the case of the individual target elements arrangement illustrated it will be noted that the generally 8-corner star shaped arrangement has an angular separation (around the central reference target) of the order of 25° in most cases. This illustrated arrangement has been found particularly convenient for maximising the

detection of arcuate, quadrant, hemianopic, and altitudinal visual field defects as well as a nasal step. Desirably, the sequence is arranged on the target so that a fairly early section e.g., numbers 2 to 4 in the above card are disposed in the region of the subject's blind spot. This helps to provide an early indication of the subject following the test procedure correctly.

Other modifications may also be made to the form of the target. Thus, for example, other colours could be used e.g., a black background with a white central target 3 and red individual target elements. Desirably an annular area around the central target 3 having a radius r subtending an angle of the order of 5° is left clear as shown in Fig. 1 in order to aid observation of this target 3. Other forms of visual target could also be used including representations of a card as illustrated and described above by optical and/or electronic means for example by projection of a transparency or display on a VDU such as a cathode ray tube, LCD or electrochemiluminescent display device. Also if assessment of a greater part of the field of vision than the abovementioned central part is required, then a concave target with a larger radius R could be employed extending up to angles α of the order of 70 or even 90° for a given viewing distance L .

Where an electronic display means is utilized the device may conveniently be formed and arranged so that the individual target elements 2 are individually transiently generated in said predetermined sequence.

Where an optical display means is used this is conveniently in the form of a set of coloured slides each with a different central target for viewing with a matching conventional hand held viewer or with a conventional slide projector. In one embodiment one slide is conveniently provided without a central target so that it can be placed in a suitable conventional stereoscopic viewer before the normal eye to enable the other eye to be tested with one of the other test slides. This particular embodiment allows individuals with unocular central field defects to test their own field using this invention. Naturally a similar test procedure can be carried out using a pair of printed cards which are compatible with existing stereoscopes described hereinabove.

Example—Method of detecting hidden field of vision defects

The method is carried out using a self-assessment test card 1 as described above together with a record sheet 10 (see Fig. 2) on which are displayed two reduced size representations 11, 12 for use in recording the results of the test procedure for respective ones of the subject's eyes 5. The test procedure is carried out in accordance with the following instructions:

(i) Place the chart on a flat surface in a well lit room so that its centre is at a level 33 cm from your face.

(ii) Test the right eye first. Keep the other eye completely converged throughout the procedure.

(iii) T check your position look down at the star below. If you are testing the right eye the letter R should disappear. If the left eye is being tested the letter L should disappear.

(iv) Look at a number on the chart. Without taking your eye off that number ask yourself whether you can still see the central black spot out of the corner of your eye. Do this with each number from 1 to 100, taking at least one second per number.

(v) The numbers which are associated with disappearance of the central spot should be circled on the record sheet.

(vi) Repeat the procedure with your other eye.

Results

Fig. 3 shows part of a record sheet obtained by the above method showing the results for one of the subject's eyes. A substantial visual defect area 13 may be seen extending from the blind spot area 14.

Claims

1. An oculo-perimetric device for use in measuring the field of vision of a subject which device comprises an extended area visual target (1) having a large plurality of generally regularly, angularly and/or radially, spaced apart individual target elements (2) disposed around a central reference target element (3) across substantially the whole of the area within a predetermined radial separation (R) from said reference target element (3), said individual target elements (2) being provided with sequence indicating means (4) formed and arranged so as to define a visually discernible predetermined sequence for fixing of an eye (5) of the subject, in use of the device, on successive adjacent individual target elements (2), said central reference target element (3) being formed and arranged so as to be visually more prominent than said individual target elements (2).

2. A device according to claim 1 wherein said individual target elements (2) are of a pale unsaturated colour whilst said central reference target (3) is of a dark saturated colour.

3. A device according to claim 2 wherein said individual target elements (2) are of a colour selected from light blue, light green and pink.

4. A device according to claim 2 or claim 3 wherein said central reference target is black.

5. A device according to any one of claims 1 to 4 wherein said individual target elements (2) are in the form of a series of consecutive numbers constituting sequence indicating means.

6. A device according to any one of claims 1 to 5 wherein the sequence indicating means comprise lines (4) extending between successive adjacent individual target elements (2).

7. A device according to any one of the preceding claims wherein a central area within a predetermined radial separation (r) of from 10 to 20% of said predetermined radial separation (R) defining said area substantially occupied by said

individual target elements (2), is substantially free of any target elements or markings.

8. A device according to any one of the preceding claims which includes observation distance determining means in the form of left and right hand indicia (9, 8) at a predetermined distance (I) either side of a reference index (7) such that when said reference index is observed with one eye (5) at a predetermined distance (L) from said target (1) such that the predetermined radial separation (R) defining the area substantially occupied by the individual target elements (2) subtends an angle (α) at the eye of from 20 to 30°, the respective one of said left and right indicia (9, 8) corresponds with the blind spot of said eye (5).

9. A device according to any one of the preceding claims wherein said target is in the form of a planar medium with permanent markings thereon.

10. A device according to any one of claims 1 to 8 wherein said target comprises an electronic and/or optical display screen with said individual and central reference target elements (2, 3) electronically and/or optically generated and displayed thereon.

11. A device according to claim 10 which device is formed and arranged so that said individual target elements (2) are individually transiently generated in said predetermined sequence.

Patentansprüche

1. Perimeter zur Messung des Sehfeldes einer Testperson, umfassend einen ausgedehnten Targetbereich (1) mit einer großen Anzahl von im allgemeinen regelmäßig, im Winkel zueinander und/oder radial voneinander beabstandeten einzelnen Targetelementen (2), die um ein zentrales Referenztargetelement (3) über den im wesentlichen ganzen Bereich innerhalb einer vorbestimmten radialen Teilung (R) von dem Referenztargetelement (3) angeordnet sind, wobei die einzelnen Targetelemente (2) mit einer Folge indizierenden Mitteln (4) versehen und so angeordnet sind, daß sie eine visuell wahrnehmbare vorbestimmte Folge zum Fixieren eines Auges (5) einer Testperson während der Verwendung des Gerätes auf aufeinanderfolgende benachbarte einzelne Targetelemente (2) festlegen, und wobei das zentrale Referenztargetelement (3) so ausgestaltet und angeordnet ist, daß es visuell hervorsteht als die einzelnen Targetelemente (2) ist.

2. Perimeter nach Anspruch 1, bei dem die einzelnen Targetelemente (2) von einer hellen, ungesättigten Farbe sind, während das zentrale Referenztarget (3) von einer dunklen, satten Farbe ist.

3. Perimeter nach Anspruch 2, bei dem die einzelnen Targetelemente (2) eine Farbe ausgewählt aus Hellblau, Hellgrün und Rosa aufweisen.

4. Perimeter nach Anspruch 2 oder 3, bei dem das zentrale Referenztarget schwarz ist.

5. Perimeter nach einem der Ansprüche 1 bis 4, bei dem die einzelnen Targetelemente (2) in Form

einer Reihe auf inanderfolgender Zahlen, welche die eine Folge indizierenden Mittel darstellen, aufgebaut sind.

6. Perimeter nach einem der Ansprüche 1 bis 5, dadurch gekennzeichnet, daß die eine Folge indizierenden Mittel Linien (4) umfassen, die zwischen aufeinanderfolgenden benachbarten einzelnen Targetelemente verlaufen.

7. Perimeter nach einem der vorhergehenden Ansprüche, bei dem ein zentraler Bereich innerhalb einer vorbestimmten radialen Teilung (r) von 10 bis 20% der erwähnten vorbestimmten radialen Teilung (R), welche den im wesentlichen mit den einzelnen Targetelementen (2) bedeckten Bereich festgelegt, im wesentlichen frei ist von jeglichen Targetelementen oder Markierungen.

8. Perimeter nach einem der vorhergehenden Ansprüche, das den Betrachtungsabstand bestimmende Mittel in Form eines rechten und linken Zeichens (9, 8) in einem bestimmten Abstand (l) auf jeder Seite eines Referenzzeichens (7) umfaßt, so daß das betreffende eine Zeichen (9, 8) mit dem blinden Punkt des Auges (5) korrespondiert, wenn das Referenzzeichen mit diesem Auge (5) aus einem bestimmten Abstand (L) von dem Target (1) betrachtet wird, so daß die bestimmte radiale Teilung (R), die den im wesentlichen mit den einzelnen Targetelementen (2) bedeckten Bereich festgelegt, einen Winkel (α) zum Auge von 20 bis 30° einschließt.

9. Perimeter nach einem der vorhergehenden Ansprüche, bei dem das Target in Form eines planaren Mediums mit dauerhaft darauf angebrachten Markierungen ausgebildet ist.

10. Perimeter nach einem der Ansprüche 1 bis 8, bei dem das Target aus einem elektronischen und/oder optischen Anzeigeschirm besteht, wobei die einzelnen Targetelemente (2) und das Referenztargetelement (3) elektronisch und/oder optisch generiert und auf dem Schirm abgebildet werden.

11. Perimeter nach Anspruch 10, welches so ausgebildet und angeordnet ist, daß die einzelnen Targetelemente (2) einzeln transient in der vorbestimmten Reihenfolge erzeugt werden.

Revendications

1. Dispositif de périmétrie oculaire utilisable pour la mesure du champ de vision d'un sujet, ce dispositif comprenant une cible visuelle (1) de surface étendue comportant un nombre élevé d'éléments de cible individuels (2) sensiblement régulièrement espacés angulairement et/ou radialement les uns des autres et disposés autour d'un élément de cible central de référence (3) sensiblement sur toute la surface à l'intérieur d'une distance radiale prédéterminée (R) par rapport audit élément de cible de référence (3), lesdits éléments de cible individuels (2) étant pourvus de moyens d'indication de séquence (4) formés et agencés d'une manière à définir une séquence prédéterminée visuellement discernable pour la fixation d'un oeil (5) du sujet, pendant l'utilisation du dispositif, sur des éléments de cible individuels

adjacents successifs (2), ledit élément de cible de référence central (3) étant formé et disposé d'une manière à être visuellement plus en évidence que lesdits éléments de cible individuels (2).

2. Dispositif suivant la revendication 1, dans lequel lesdits éléments de cible individuels (2) sont d'une couleur non saturée pâle tandis que ledit élément de référence central (3) est d'une couleur saturée sombre.

3. Dispositif suivant la revendication 2, dans lequel lesdits éléments de cible individuels (2) sont d'une couleur choisie parmi bleu clair, vert clair et rose.

4. Dispositif suivant la revendication 2 ou la revendication 3, dans lequel ledit élément de cible de référence central est noir.

5. Dispositif suivant l'une quelconque des revendications 1 à 4, dans lequel lesdits éléments de cible individuels (2) sont sous la forme d'une série de nombres consécutifs constituant des moyens d'indication de séquence.

6. Dispositif suivant l'une quelconque des revendications 1 à 5, dans lequel les moyens d'indication de séquence comprennent des lignes (4) s'étendant entre les éléments de cible individuels adjacents successifs (2).

7. Dispositif suivant l'une quelconque des revendications précédentes, dans lequel une zone centrale, à l'intérieur d'une distance radiale prédéterminée (r) représentant 10 à 20% de ladite distance radiale prédéterminée (R) définissant ladite surface sensiblement occupée par lesdits éléments de cible individuels (2), est sensiblement exempte d'éléments ou marques de cible.

8. Dispositif suivant l'une quelconque des revendications précédentes, qui comprend des moyens de détermination de la distance d'observation, sous la forme de repères gauche et droit (9, 8) situés à une distance prédéterminée (l) de chaque côté d'un repère de référence (7) de sorte que, lorsque ledit repère de référence est observé d'un seul oeil (5) à une distance prédéterminée (L) de ladite cible (1) telle que la distance radiale prédéterminée (R) définissant la surface sensiblement occupée par les éléments de cible individuels (2) sous-tend un angle (α) de 20 à 30° à l'endroit de l'oeil, le repère respectif desdits repères gauche et droit (9, 8) correspond au point aveugle dudit oeil (5).

9. Dispositif suivant l'une quelconque des revendications précédentes, dans lequel ladite cible est sous la forme d'un support plan portant des marques permanentes.

10. Dispositif suivant l'une quelconque des revendications 1 à 8, dans lequel ladite cible comprend un écran d'affichage électronique et/ou optique, lesdits éléments de cible individuels et de référence central (2, 3) étant engendrés et affichés électroniquement et/ou optiquement sur ledit écran.

11. Dispositif suivant la revendication 10, ce dispositif étant formé et agencé de sorte que lesdits éléments de cible individuels (2) sont engendrés individuellement d'une façon transitoire dans ladite séquence prédéterminée.

